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New or Noteworthy Chromosome Records in *Arisaema* (Araceae) (3)

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Chromosome numbers of 15 species and one hybrid of *Arisaema* were newly determined. The results are compared with previous reports and are discussed for each of the sections. A rare number 2n = 30 was found in *A. scortechnii* of sect. Anomala and in *A. calcareum* (= *A. jinshajianense*) of sect. Fimbriata. Diploid plants of *A. yunnanense* (2n = 24), which is morphologically distinguished by the pedate leaves from tetraploid plants with trifoliolate leaves, were reported for the first time. A Chinese species *A. bockii* was 2n = 26 and cytologically distinct from Japanese *A. sikokianum* and *A. sazensoo* with 2n = 28 chromosomes.

Key words: *Arisaema*, chromosome.

This study supplements the previous reports (Murata and Iijima 1983, Murata 1990) on chromosome numbers in the genus *Arisaema*. The chromosome numbers of 15 species and one hybrid were newly determined. The results are compared with previous reports and are discussed for each of the sections. The chromosome numbers enumerated in Petersen (1989) are cited without original reference. In Murata and Wu (2003), this paper was cited as Murata et al. (in press).

Materials and Methods

Root tips were collected from the natural habitat in the field, or obtained from plants cultivated in botanical gardens. After pretreatment with 0.2 % colchichine for four hours at room temperature, root tips were fixed in 45 % glacial acetic acid and then macerated in 1N HCl, stained with 2 % aceto-orcein and squashed. Voucher specimens are kept in the Herbaria, The University of Tokyo (TI) and Kunming Institute of Botany (KUN).

Results and Discussion

In this part chromosome numbers determined in this study and a short note for identification of the material are given for each species. Additional notes are provided for each of the sections.

(1) Sect. **Anomala** G. Gusman & L. Gusman

Arisaema balansae Engler 2n = 28 (Fig. 1A). Voucher specimen: Vietnam, TamDao (cult. at Bot. Gard. Univ. Tokyo). Apr. 1, 1995, J. Murata s. n. (TI).

Arisaema bannaense H. Li 2n = 28 (Fig. 1B). Voucher specimen: China, Yunnan, Hekou Co. Mar. 1, 1994, S. K. Wu & al. 874 (TI, KUN). This species appears to be very close to *A. garrettii* known from northern Thailand, and is distinguished by the spadix appendage somewhat verrucose (not smooth) in the upper part. This species is occasionally found in limestone area in the southen Yunnan Province, China.

Arisaema lihenganum J. Murata & S. G. Wu 2n = 28. Voucher specimen: China, Guangxi, Pinmeng, Chingangshan, alt. 1000 m (grown from seed in the greenhouse of Setsunan University), Feb. 1, 2001, J. Murata & H. Murata s. n. (TI, KUN).

Arisaema petelotii K. Krause 2n = 28 (Fig. 1C). Voucher specimen: Vietnam, Mt. Bavi (field No. 908) (cult. at Bot. Gard. Univ. Tokyo), Apr. 1, 1995, J. Murata s. n. (TI). The inflorescence of this species is similar to *A. balansae* but this species always has distinct pseudostem and very thick rhizome.

Arisaema pingbianense H. Li 2n = 28. Voucher specimen: China, Yunnan, Luchun, Oct. 23, 1995, S. K. Wu & al. 2037 (TI, KUN). This rare species is distributed only southernmost part of Yunnan Province, China. It is very similar to *A. omkoiense* G. Gusman of northern Thailand and distinguished by the large white patch (mark) at the base of the spathe blade and well branched rhizome more slender than *A. omkoiense*. It should be noted that the materials used for the chromosome count by Hotta (1971) as *A. album* (1971) and by Murata (1990) as *A. pingbianense* were both *A. omkoiense* (2n = 28).

Arisaema scortechinii Hook. f. 2n = 30. Voucher specimen: Malaysia, Jerian, Air Trujun (collection no. 10124) (cult. at Bot. Gard. Setsunan Univ.) Nov. 29, 2003, H. Murata & J. Murata s. n. (TI).

Murata (1984) recognized three subgroups in sect. Fimbriata, i. e. "Fimbriata 1" characterized by having both rhizome and pseudostem, "Fimbriata 2" characterized by having tuber and lacking pseudostem and "Fimbriata 3" by having rhizome and lacking pseudostem. Section Anomala, recognized by Gusman and Gusman (2002) and validly described in Hetterscheid and Gusman (2003) was characterized by having rhizome and actually consists of Murata's "Fimbriata 1" and "Fimbriata 3". In the previous reports all the species of this section were found to have 2n = 28 chromosomes and *A. scorthchinii* with 2n = 30 is the first an example of exceptional number.

(2) Sect. **Fimbriata** Engler

Arisaema calcareum H. Li (= *A. jinshajiangense* H. Li) 2n = 30 (Fig. 1D). Voucher specimen: China, Yunnan, Malipo (cult. at Bot. Gard. Univ. Tokyo), May 30, 1994, J. Murata s. n. TI).

The original description and the accompanying figures of *A. calcareum* H. Li (Li et al. 1977) were a mixture of two species, based on male plants of *A. petelotii* K. Krauze and female plants of a species that was later described as *A. jinshajianense* H. Li (1985). Because the type specimen is a female plant of the latter species, *A. jinshajianense* is recognized as a synonym of *A. calcareum*.

Arisaema laminatum Blume 2n = 24 (Fig. 1E). Voucher specimen: Indonesia, South Kalimantan, Barabai. Oct. 23, 1990, J. Murata & al. 26175 (TI).

Arisaema lidaense J. Murata & S. G. Wu 2n = 24 (Fig. 1F). Voucher specimen: China, Yunnan, Wenshan Distr. Funin, Lidazhen, ca. 1300 m, Oct. 11, 1997, H. Akiyama & al. 078 (TI, KUN).

Arisaema prazeri Hook. f. 2n = 26 (Fig. 2A). Voucher specimen: Thailand (cult. at Bot. Gard. Univ. Tokyo). Mar. 5, 1992, J. Murata s. n. (TI).

Arisaema sinii K. Krause 2n = 28 (Fig.

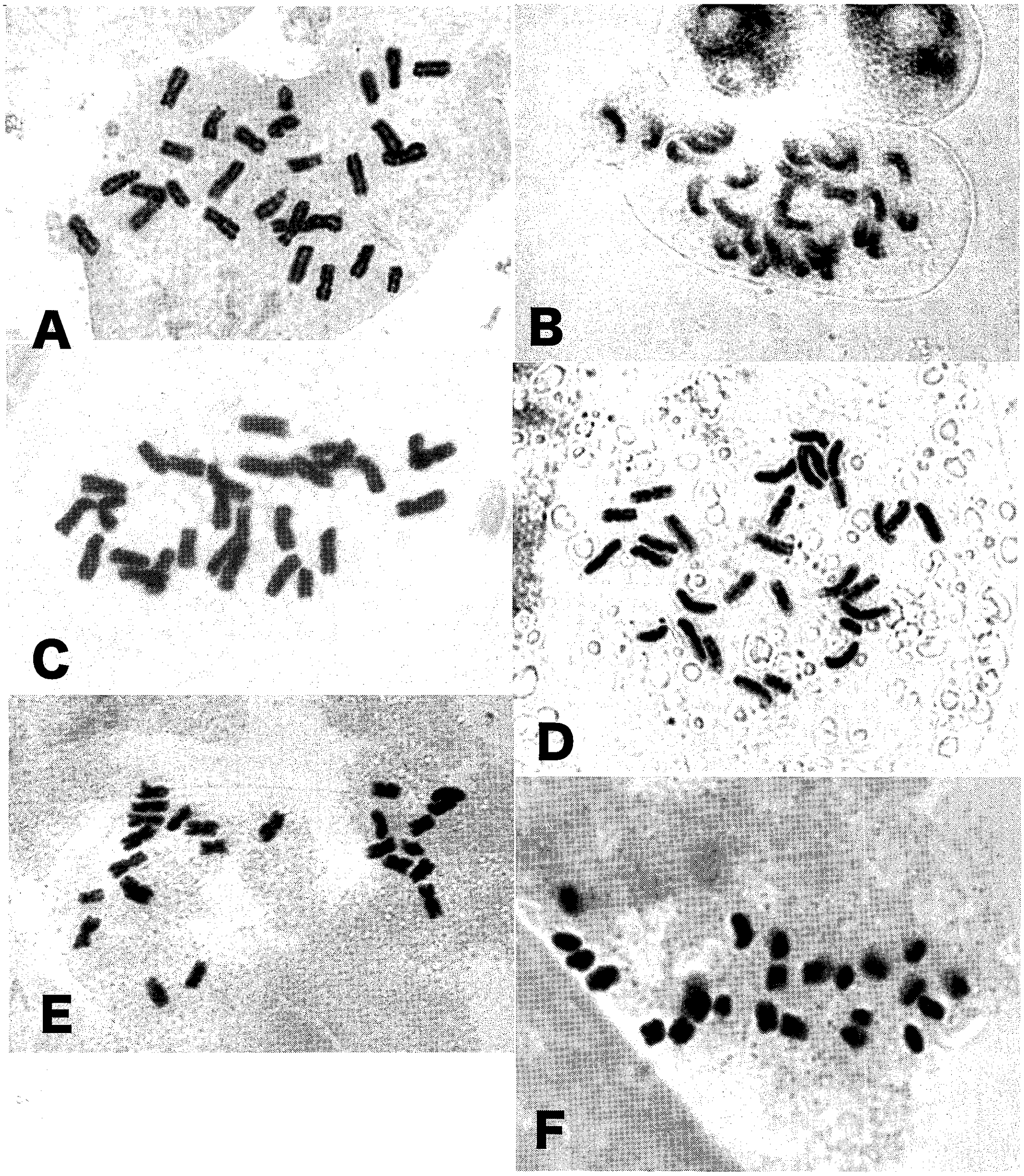

Fig. 1. Somatic chromosomes of *Arisaema* (×1200). A. *A. balansae* (2n = 28). B. *A. bannaense* (2n = 28). C. *A. petelotii* (2n = 28). D. *A. calcareum* (2n = 30). E. *A. laminatum* (2n = 24). F. *A. lidaense* (2n = 24).

2B). Voucher specimen: China, Yunnan, Kunming, Guodong, Jun. 8, 1992, J. Murata 4026 (TI).

Section Fimbriata recognized here corresponds to Murata's (1984) "Fimbriata 2" in which the underground stem is tuberous (not rhizomatous). In the present circumscription this group does not have unique apomorphic

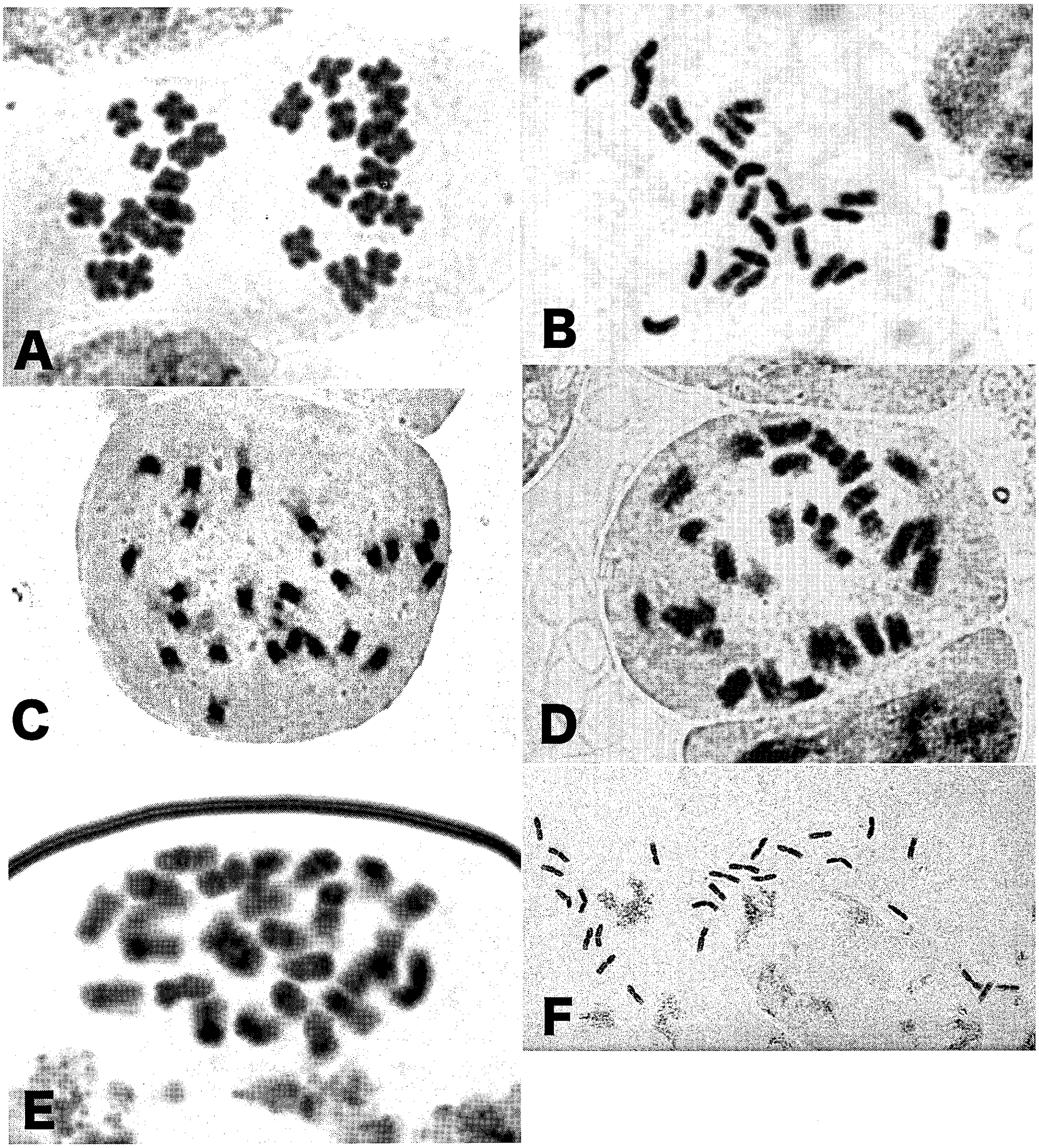

Fig. 2. Somatic chromosomes of *Arisaema* (A–E ×1200; F ×500). A. *A. prazeri* (2n = 26). B. *A. sinii* (2n = 28). C. *A. yunnanense* (2n = 24). D. *A. clavatum* (2n = 28). E. *A. bockii* (2n = 26). F. *A. ovale* var. *inaense* (2n = 26).

characters and the wide variety of chromosome numbers may also suggest that this group is polyphyletic.

(3) Sect. **Tortuosa** Engler

Arisaema yunnanense Buchet (with five leaflets) 2n = 24 (Fig. 2C). Voucher specimen: China, Yunnan, near Baihanchang, along Jinshajian River, Aug. 2, 1996, J.

Murata & al. s. n. (TI).

The plants here tentatively cited as a five-leaflet form of *A. yunnanense* were called *A. yunnanense* var. *aridum* (H. Li) G. Gusman & L. Gusman (Gusman and Gusman 2002) but the identity of *A. aridum* H. Li, when considered together with *A. saxatile* Buchet, *A. mairei* H. Lév. and *A. wumengense* H. Li, is greatly confusing. Biologically, however, it is reasonable to consider that this type of plant is a diploid of *A. yunnanense*, which is characterized by having a trifoliolate leaf, because the base number x = 12 is unique in sect. Tortuosa and shared by them only. Morphologically they differ only in the number of leaflets. It is notable that a series of base number through x = 11 (in *A. odoratum* J. Murata & S. K. Wu and *A. wumengense*), 12 (in *A. yunnanense*), 13 (in *A. tortuosum* (Wall.) Schott, *A. dracontium* Nutt.) and 14 (*A. tortuosum*, *A. heterophyllum* Blume) occur in the section Tortuosa.

(4) Sect. **Clavata** Engler

Arisaema clavatum Buchet 2n = 28 (Fig. 2D). Voucher specimen: China, Sichuan, Mt. Emei, alt. 1200m, 9 March 1994, J. Murata & Y. Yang. s. n. (TI, a photograph).

(5) Sect. **Pedatisecta** Schott

Arisaema bockii Engler (= *A. engleri* Pampan.) 2n = 26 (Fig. 2E). Voucher specimen: China (purchased and cultivated at the Botanical Gardens, Univ. Tokyo) (TI).

Arisaema bockii has frequently been confused with *A. sikokianum* Franch. & Sav. and *A. sazensoo* Makino, which were reported to have 2n = 28 chromosomes. In this study it becomes clear that *A. bockii* is distinct from these species in the chromosome number.

Arisaema ovale Nakai var. **inaense** (Serizawa) J. Murata 2n = 26 (Fig. 2F). Voucher specimen: Japan, Nagano Pref., Azumi-gun, Nakabusa, Jun. 1992, J. Murata s. n. (TI).

Arisaema ovale Nakai var. **sadoense** (Nakai) J. Murata × **A. monophyllum** Nakai 2n = ca. 40 (Fig. 2G). Collected near Jakko Waterfall, Nikko in 1995 (cultivated at Tokyo Metropolitan University), 20 May 1996, J. Murata & T. Saito 960520. The occurrence of this hybrid in Nikko, Central Japan, was reported in Kobayashi et al. (2005). Putative mother species, *A. ovale* var. *sadoense* and *A. monophyllum*, are also growing in the vicinity. As the mother species are expected to have 2n = 52 and 28, respectively, the present count for the putative hybrid suggests that aneuploid triploidy have occurred.

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邑田 仁[a]，邑田裕子[b]，菅原 敬[c]，楊 永平[d]，武素功[d]：**テンナンショウ属の染色体数に関する新知見（3）**

前2報に引き続き，テンナンショウ属15種と1雑種の染色体数を報告する．

Anomala節：Anomala節はHettterscheid and Gusman (2003) によって発表されたもので，実質的にはMurata (1984) が認めたFimbriata節内の3亜群のうち，Fimbriata 1とFimbriata 3を合わせたものである．従来の報告では染色体数がいずれも$2n = 28$であり，今回見出された*A. scortechinii*の$2n = 30$ははじめての例外である．

Fimbriata節：Gusman and Gusman (2002) の認めるFimbriata節は実質的にはMurata (1984) が認めたFimbriata 2に相当する．この節は形態的特徴が多様であり，はっきりした共有派生形質も認められない．染色体数も様々であることから，この群が単系統ではない可能性がある．今後の検討が必要である．

Tortuosa節：*A. yunnanense*の染色体数$2n = 48$はTortuosa節において異質であり，その起源がはっきりしていなかったが，今回，中国雲南省の麗江付近に見られる，鳥足状に5小葉をつける*A. yunnanense*が$2n = 24$であることが明らかとなり，3小葉を持つ*A. yunnanense*はその4倍体であることが推定された．

Clavata節：*A. clavatum*は$2n = 28$で本節の他種についての従来の報告と一致する．

Pedatisecta節：中国産の*A. bockii*は$2n = 26$で，しばしば同種として扱われてきた日本産のユキモチソウやヒメテンナンショウが$2n = 28$であるのとは異なっており，別種であるという見解を支持するものである．イナヒロハテンナンショウ（*A. ovale* var. *inaense*）は$2n = 26$の2倍体であった．このことから，イナヒロハテンナンショウは，太平洋側だけに2倍体が分布し日本海側には広く倍数体が分布するヒロハテンナンショウが倍数化する以前に分化したものであると推定される．栃木県日光でヒロハテンナンショウ（$2n = 56$）とヒトツバテンナンショウ（$2n = 28$）の雑種ができていることが形態的に推定されたが，雑種と見られる個体の染色体数は$2n = 40$であり，この個体が異数倍数体間の三倍体雑種であることが確かめられた．

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